**Traditional vs Online labs**

LOS ANGELES —

 Students at Cal State are breeding fruit flies. Others are monitoring the heart rate of people on a treadmill.

These are common lab experiments. But one thing is different. The experiments are being conducted online.

Across the country, students are increasingly doing online simulations. In some cases, it replaces hands-on traditional lab work.

Virtual labs are now used in nearly every science. Online learning is popular and saves money for colleges.

**Cal State's Study Of Two Labs**

But some scientists are dismayed. They say students need to learn the practical skill of traditional lab work if they want to do more advanced research. In a traditional lab, students can touch and smell what they are working on.

Supporters of virtual labs say they don't want to get rid of traditional labs. Yet they say virtual labs can be a valuable tool for introductory science courses.

The California State University system is the largest in the nation. It is planning to add many more virtual labs for general education science courses. The courses are typically for non-science majors who are required to take a course with lab work to graduate.

Last spring, Cal State Los Angeles compared the success of students in traditional labs with those in virtual ones. They also tried a “flipped” lab model, where online students met in the classroom every two weeks.

Students in the flipped model stayed interested in the class and got better grades, the study found. It also made it possible to teach more students and save the school money.

A typical introductory biology course might include eight lab classes.

**Instant Feedback In Virtual Lab**

With virtual labs, the university can teach many more students. It can double the number of lab sessions available.

California public colleges lost billions of dollars in state funding during the tough economy a few years ago. Jobs were lost and California had less money to give to its universities. Governor Jerry Brown has called on educators to use new technologies to save money.

At Cal State, there are not enough science labs for the growing number of students, said Gerry Hanley, a university official. As a result, “students end up taking these courses later or delaying graduation.”

Cal Poly Pomona officials had to schedule a full day of lab classes on Saturdays and Sundays because of the backlog. The weekend sessions quickly filled up. This fall, the college is offering virtual labs in some classes.

Computer simulations are now common for many types of research, said Hanley. For example, they are used to study the effect of earthquakes.

In a biology lab at Cal State LA, students recently conducted a group exercise online. They designed experiments to test theories of natural selection. The program allowed them to change animals' appearance, such as the size of a bird's beak. They could also introduce predators and change the surroundings. The program gave them instant feedback.

**A Combination Of The Two**

Cal State officials hope that making it easier for students to take lab courses will help people like Gerrymi Bernardo. He is a design student. He wanted to take the lab course earlier, but couldn't schedule a class.

“As a working student, it’s really convenient being able to do this at home on my own time,” said Bernardo, age 22.

Stephanie Ugalde is a food science major. She said the virtual lab left her “disappointed not to be dissecting stuff."

Some scientists worry that colleges are too quick to use online classes. They say that there is not enough research on whether online courses work.

Paulo Blikstein directs a learning technology lab at Stanford University. His group is working on combining virtual learning with traditional lab work.

Students use robotic equipment located off-site. The equipment can be remotely controlled with a smartphone or computer. The students can, for example, send a command. They can tell the robot to add a chemical to a petri dish and capture the results on video.

Blikstein says virtual labs alone can be too simple. "And then students understand it’s not really happening, but just a simulation,” Blikstein said. “We’re finding that affects their motivation.”